β-NMR: A novel spectroscopic technique in biological inorganic chemistry?

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Nuclear magnetic resonance (NMR) spectroscopy is a powerful and versatile technique, which allows for elucidation of protein structure and dynamics. However, several biologically relevant metal ions, such as Mg^{2+}, Ca^{2+}, Cu^{+} or Zn^{2+} are problematic in conventional NMR spectroscopy due to the lack of suitable stable isotopes and limited sensitivity. Moreover, many other analytical tools fail for the same metal ions because of the closed electronic shell structure. Here we present an experimental NMR approach that is one billion times more sensitive than conventional NMR spectroscopy. The increase in sensitivity is achieved by recording the anisotropic emission of β-particles in the decay of highly spin-polarized nuclei[1,2]. β-NMR may be applied to many chemical elements and we aim to study e.g. Mg^{2+}, Ca^{2+}, Cu^{+} and Zn^{2+}. The technique has been applied in solid-state physics[3,4] but not yet in biological inorganic chemistry. Although there are still technological challenges to overcome, β-NMR spectroscopy holds considerable promise as a novel very sensitive technique in biological inorganic chemistry.

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